AMENDMENTS TO THE CLAIMS

Claims 1-42 are pending. Claim 37 has been amended, without acquiescence or prejudice to pursue in a related application. No new matter has been added. A complete listing of the current pending claims is provided below and supersedes all previous claims listing(s).

1. (Previously Presented) A method of improving signal integrity in integrated circuit designs, the method comprising:

generating a global routing plan for an integrated circuit design; and

conducting signal integrity optimization in conjunction with detailed routing of the integrated circuit design based upon the global routing plan, wherein the detailed routing is performed on spacing made available for routing allocated based on a priority determined by the signal integrity optimization.

2. (Original) The method of claim 1, wherein conducting signal integrity optimization in conjunction with detailed routing of the integrated circuit design based upon the global routing plan comprises:

(a) evaluating criticality of each of a plurality of nets in the integrated circuit design based upon the global routing plan;

(b) determining availability of routing resources in the integrated circuit design;

(c) allocating the routing resources based upon the criticality of each of the plurality of nets; and

(d) performing detailed routing of the integrated circuit design based upon allocation of the routing resources.

3. (Original) The method of claim 2, wherein the criticality of each of the plurality of nets is calculated according to the equation:

$$\text{Criticality}(n) = \text{Sensitivity}(n) / [\text{Slack}(n) - \text{WNS} + 1],$$

where WNS denotes the worst negative slack permitted in the integrated circuit design.

4. (Original) The method of claim 3, wherein the sensitivity of each of the plurality of nets is calculated according to the equation:

$$\text{Sensitivity}(n) = (D1 - D2) / (C1 - C2),$$

where D1 denotes the delay from a first node of a net to a second node of the net without extra spacing, D2 denotes the delay from the first node of the net to the second node of the net with extra spacing, C1 denotes the total capacitance of the net without extra spacing, and C2 denotes the total capacitance of the net with extra spacing.

5. (Original) The method of claim 3, wherein the slack of each of the plurality of nets is calculated according to the equation:

$$\text{Slack}(n) = RAT - AT,$$

where RAT denotes the required arrival time of a signal from a first terminal of a net to a second terminal of the net and AT denotes the actual arrival time of the signal from the first terminal of the net to the second terminal of the net.

6. (Original) The method of claim 2, wherein determining availability of routing resources in the integrated circuit design comprises:

computing supply and demand of routing resources in the integrated circuit design; and assessing congestion in the integrated circuit design.

7. (Original) The method of claim 6, wherein congestion is calculated according to the equation:

$$\text{Congestion} = \text{Demand} / \text{Supply}.$$

8. (Original) The method of claim 6, wherein supply of routing resources is calculated according to the equation:

$$\text{Supply} = T,$$

where T denotes the total length of a plurality of routing tracks in the integrated circuit design.

9. (Original) The method of claim 6, wherein the demand of routing resources is calculated according to the equation:

$$\text{Demand} = \sum [L(n) + X(n)] \text{ for all nets},$$

where L(n) denotes the length of a net and X(n) denotes the extra track length needed when the net is given extra spacing.

10. (Original) The method of claim 9, wherein X(n) changes depending upon a ratio TL / T, where TL denotes the total length of the plurality of nets and T denotes the total length of a plurality of routing tracks in the integrated circuit design.

11. (Original) The method of claim 10, wherein when the ratio TL / T ≈ 1, X(n) is calculated according to the equation:

$$X(n) = 2 * L(n).$$

12. (Original) The method of claim 10, wherein when the ratio TL / T ≤ 0.5, X(n) is calculated according to the equation:

$$X(n) = L(n).$$

13. (Original) The method of claim 10, wherein when the ratio TL / L > 0.5 and not ≈ 1, X(n) is calculated according to the equation:

$$X(n) = 2 * L(n) * (TL / L).$$

14. (Original) The method of claim 6, wherein allocating the routing resources based upon the criticality of each of the plurality of nets comprises:

assigning extra spacing to a most critical net not yet processed.

15. (Original) The method of claim 14, wherein extra spacing is assigned only when congestion is below a stop criteria.

16. (Original) The method of claim 15, wherein the stop criteria is 95%.

17. (Original) The method of claim 15, wherein the stop criteria is adjustable.

18. (Original) The method of claim 1, wherein signal integrity optimization and detailed routing are conducted on a window-by-window basis.

19. (Original) The method of claim 18, wherein signal integrity optimization and detailed routing are iterative.

20. (Original) The method of claim 19, wherein the size, shape, and/or position of each window changes with each iteration.

21. (Original) The method of claim 1, wherein conducting signal integrity optimization in conjunction with detailed routing of the integrated circuit design based upon the global routing plan comprises:

(a) evaluating criticality and sensitivity of each of a plurality of nets in the integrated circuit design based upon the global routing plan;

(b) determining availability of routing resources in the integrated circuit design;

(c) allocating the routing resources based upon the criticality and sensitivity of each of the plurality of nets; and

(d) performing detailed routing of the integrated circuit design based upon allocation of the routing resources.

22. (Original) The method of claim 21, wherein the criticality of each of the plurality of nets is calculated according to the equation:

$$\text{Criticality}(n) = \text{Sensitivity}(n) / [\text{Slack}(n) - \text{WNS} + 1],$$

where WNS denotes the worst negative slack permitted in the integrated circuit design.

23. (Original) The method of claim 22, wherein the slack of each of the plurality of nets is calculated according to the equation:

$$\text{Slack}(n) = \text{RAT} - \text{AT},$$

where RAT denotes the required arrival time of a signal from a first terminal of a net to a second terminal of the net and AT denotes the actual arrival time of the signal from the first terminal of the net to the second terminal of the net.

24. (Original) The method of claim 21, wherein the sensitivity of each of the plurality of nets is calculated according to the equation:

$$\text{Sensitivity}(n) = (D1 - D2) / (C1 - C2),$$

where D1 denotes the delay from a first node of a net to a second node of the net without extra spacing, D2 denotes the delay from the first node of the net to the second node of the net with

extra spacing, C1 denotes the total capacitance of the net without extra spacing, and C2 denotes the total capacitance of the net with extra spacing.

25. (Original) The method of claim 21, wherein determining availability of routing resources in the integrated circuit design comprises:

computing supply and demand of routing resources in the integrated circuit design; and assessing congestion in the integrated circuit design.

26. (Original) The method of claim 25, wherein congestion is calculated according to the equation:

$$\text{Congestion} = \text{Demand} / \text{Supply}.$$

27. (Original) The method of claim 25, wherein supply of routing resources is calculated according to the equation:

$$\text{Supply} = T,$$

where T denotes the total length of a plurality of routing tracks in the integrated circuit design.

28. (Original) The method of claim 25, wherein the demand of routing resources is calculated according to the equation:

$$\text{Demand} = \sum [L(n) + X(n)] \text{ for all nets},$$

where L(n) denotes the length of a net and X(n) denotes the extra track length needed when the net is given extra spacing.

29. (Original) The method of claim 28, wherein X(n) changes depending upon a ratio TL / T, where TL denotes the total length of the plurality of nets and T denotes the total length of a plurality of routing tracks in the integrated circuit design.

30. (Original) The method of claim 29, wherein when the ratio TL / T ≈ 1, X(n) is calculated according to the equation:

$$X(n) = 2 * L(n).$$

31. (Original) The method of claim 29, wherein when the ratio TL / T $\leq$ 0.5, X(n) is calculated according to the equation:

$$X(n) = L(n).$$

32. (Original) The method of claim 29, wherein when the ratio TL / L > 0.5 and not $\approx$ 1, X(n) is calculated according to the equation:

$$X(n) = 2 * L(n) * (TL / L).$$

33. (Original) The method of claim 25, wherein allocating the routing resources based upon the criticality and sensitivity of each of the plurality of nets comprises:

assigning extra spacing to a most critical net not yet processed when a last net processed is a sensitive net or when the last net processed is more sensitive than a most sensitive net not yet processed; and

assigning extra spacing to the most sensitive net not yet processed when the last net processed is a critical net and when the last net processed is as sensitive as or less sensitive than the most sensitive net not yet processed.

34. (Original) The method of claim 33, wherein extra spacing is assigned only when congestion is below a stop criteria.

35. (Original) The method of claim 34, wherein the stop criteria is 95%.

36. (Original) The method of claim 34, wherein the stop criteria is adjustable.

37. (Currently Amended) A computer program product that includes a <u>volatile or non-volatile</u> computer readable <u>storage</u> medium, the <u>volatile or non-volatile</u> computer readable <u>storage</u> medium comprising instructions which, when executed by a processor, causes the processor to execute a process for improving signal integrity in integrated circuit designs, the process comprising:

generating a global routing plan for an integrated circuit design; and

conducting signal integrity optimization in conjunction with detailed routing of the integrated circuit design based upon the global routing plan, wherein the detailed routing is

performed on spacing made available for routing allocated based on a priority determined by the signal integrity optimization.

38. (Previously Amended) A system for improving signal integrity in integrated circuit designs, the system comprising:

means for generating a global routing plan for an integrated circuit design; and

means for conducting signal integrity optimization in conjunction with detailed routing of the integrated circuit design based upon the global routing plan, wherein the detailed routing is performed on spacing made available for routing allocated based on a priority determined by the signal integrity optimization.

39. (Previously Presented) The system of claim 38, wherein means for conducting signal integrity optimization in conjunction with detailed routing of the integrated circuit design based upon the global routing plan comprises:

(a) means for evaluating criticality of each of a plurality of nets in the integrated circuit design based upon the global routing plan;

(b) means for determining availability of routing resources in the integrated circuit design;

(c) means for allocating the routing resources based upon the criticality of each of the plurality of nets; and

(d) means for performing detailed routing of the integrated circuit design based upon allocation of the routing resources.

40. (Previously Presented) The system of claim 39, wherein the criticality of each of the plurality of nets is calculated according to the equation:

$$\text{Criticality}(n) = \text{Sensitivity}(n) / [\text{Slack}(n) - \text{WNS} + 1],$$

where WNS denotes the worst negative slack permitted in the integrated circuit design.

41. (Previously Presented) The product of claim 37, wherein conducting signal integrity optimization in conjunction with detailed routing of the integrated circuit design based upon the global routing plan comprises:

(a) evaluating criticality of each of a plurality of nets in the integrated circuit design based upon the global routing plan;

(b) determining availability of routing resources in the integrated circuit design;

(c) allocating the routing resources based upon the criticality of each of the plurality of nets; and

(d) performing detailed routing of the integrated circuit design based upon allocation of the routing resources.

42. (Previously Presented) The product of claim 41, wherein the criticality of each of the plurality of nets is calculated according to the equation:

$$\text{Criticality}(n) = \text{Sensitivity}(n) / [\text{Slack}(n) - \text{WNS} + 1],$$

where WNS denotes the worst negative slack permitted in the integrated circuit design.